

EXHIBIT 1

Expert Report of

Morris L. Maslia, P.E., D.WRE, DEE, Fellow EWRI

Prepared by:

Morris L. Maslia

Morris L. Maslia

M. L. Maslia Consulting Engineer
Registered Professional Engineer, GA #PE012689

3360 Norfolk Chase Drive, Peachtree Corners, GA 30092
Mobile: +1 (404) 431-0035 — Email: H2OBoy54@gmail.com
<https://www.linkedin.com/in/mlmaslia/>

Table of Contents

Table of Contents	2
List of Figures	5
List of Tables	7
1.0 Introduction	9
2.0 Details of Experience	9
2.1 U.S. Geological Survey (USGS), 1980–1989.....	10
2.2 Geosyntec Consultants, 1990–1992	12
2.3 Agency for Toxic Substances and Disease Registry (ATSDR),1992–2017	12
3.0 Awards	16
4.0 Professional Registration and Certifications	17
5.0 Scope of Work	17
6.0 Summary of Opinions	17
7.0 U.S. Marine Corps Base Camp Lejeune, North Carolina: Reconstructing Volatile Organic Compound Contamination of Drinking-Water Supplies	19
7.1 Introduction	20
7.2 Water Supply and Contamination at Camp Lejeune	22
7.3 Water-Modeling and Study Objectives	26
7.4 Historical Reconstruction Methods	27
7.4.1 Overview	27
7.4.2 Information and Data Discovery.....	29
7.4.3 Water-Modeling Approach and Simulation Tools.....	31
7.4.4 Model Calibration, Sensitivity, and Uncertainty	44
7.5 Historical Reconstruction Analyses and Results	45
7.5.1 Tarawa Terrace (TT)	47
Level 1 Calibration (Predevelopment Conditions).....	48
Level 2 Calibration (Transient Conditions)	49
Level 3 Calibration (Contaminant Fate and Transport)	51
Selected Simulation Results: Tarawa Terrace	53
January 1958	54
January 1968	54
December 1984.....	54

December 1994.....	54
Well TT-26	57
Level 4 Calibration (Mixing Model).....	58
Post-Audit of the Tarawa Terrace Models	61
Uncertainty.....	61
Water-Supply Well Scheduling Analysis.....	62
Sensitivity Analysis	62
Probabilistic Analysis	62
Conclusions Regarding Tarawa Terrace	68
7.5.2 Hadnot Point (HP).....	69
Level 1 Calibration (Predevelopment Conditions).....	72
Level 2 Calibration (Transient Conditions)	72
Level 3 Calibration (Contaminant Fate and Transport)	74
PCE and TCE	74
Benzene.....	80
Liner Control Model (LCM) Methodology.....	82
Level 4 Calibration (Mixing Model).....	84
Uncertainty	87
Sensitivity Analysis	87
Uncertainty	88
Sensitivity Analysis	88
Probabilistic Analysis	90
Conclusions Regarding Hadnot Point	91
7.5.3 Holcomb Boulevard (HB)	93
Conclusions Regarding Holcomb Boulevard.....	94
7.5.4 Discussion and Conclusions.....	97
7.6 Peer Review of ATSDR Analyses, Results, and Reports.....	99
7.7 Scientific Discourse.....	99
7.7.1 Department of the Navy (DON) Comments on the Tarawa Terrace Models and ATSDR Response.....	100
7.7.2 National Research Council Report on Camp Lejeune and ATSDR Response	101
7.7.3 ATSDR Response to Ground Water Journal Article on Camp Lejeune	102
8.0 References	104

9.0 Glossary and Abbreviations	115
Appendix A — Curriculum Vitae for Morris L. Maslia, P.E.	120
Appendix B — The ATSDR Water Modeling Team for Historical Reconstruction at U.S. Marine Corps Base Camp Lejeune, North Carolina	144
Appendix C — Exposure-Dose Reconstruction Program: Overview of Strategy, Agency for Toxic Substances and Disease Registry, March 1993.....	146
Appendix D — Dover Township, Toms River, New Jersey Childhood Cancer Cluster Investigation	159
Appendix E — Information Sources Used to Extract Model-Related Data for Historical Reconstruction	165
Appendix F — Summaries of ATSDR's Tarawa Terrace Chapter Reports.....	174
Appendix G — Summaries of ATSDR's Hadnot Point–Holcomb Boulevard Chapter Reports and Supplemental Information.....	179
Appendix H1 — Tarawa Terrace Water Treatment Plant Reconstructed (Simulated) Mean Monthly Finished Water Concentrations for Single-Specie Tetrachloroethylene (PCE) Using MT3DMS Model and for Multispecies, Multiphase PCE (Trichloroethylene [TCE], <i>trans</i>-1,2-Dichloroethylene [1,2-tDCE], and Vinyl Chloride [VC]) Using TechFlowMP Model	185
Appendix H2 — Tarawa Terrace Water Treatment Plant Reconstructed (Simulated) Mean Monthly Finished Water Concentration of Single-Specie Tetrachloroethylene (PCE) and Range of Concentrations Derived from Monte Carlo Simulation	198
Appendix I —Reconstructed (Simulated) Mean Monthly Concentrations of Selected Water-Supply Wells, for Tetrachloroethylene (PCE), Trichloroethylene (TCE), <i>trans</i>-1,2-Dichloroethylene (1,2-tDCE), Vinyl Chloride (VC), and Benzene, Hadnot Point–Holcomb Boulevard Study Area	208
Appendix J — Hadnot Point Water Treatment Plant Reconstructed (Simulated) Mean Monthly Finished Water Concentrations	224
Appendix K — Holcomb Boulevard Water-Distribution System Reconstructed (Simulated) Mean Monthly Finished Water Concentrations	240
Appendix L — ATSDR Response to Department of the Navy's Letter on: Assessment of ATSDR Water Modeling for Tarawa Terrace (ATSDR 2009).....	246
Appendix M — ATSDR Response to National Research Council Report on Contaminated Water-Supplies at Camp Lejeune: Assessing Potential Health Effects (NRC 2009)	273
Appendix N — ATSDR Editorial Response in Ground Water Journal (Maslia et al. 2012) to the Article, "Complexities in Hindcasting Models—When Should We Say <i>Enough Is Enough</i>?" by T. P. Clement (2010)	310
Appendix O — Post-Audit of the Tarawa Terrace Flow and Transport Model, N. L. Jones and R. Jeffrey Davis, Integral Consulting, Inc., October 25, 2024	319
Appendix P — Reliance Materials.....	393

MODFLOW-96. Simulated mass loading occurred at a constant rate of 1,200 grams per day using monthly stress periods representing the period January 1953–December 1984. The complete simulation time was represented by the period January 1951–December 1994. Until 1984, the vast majority of simulated PCE-contaminated groundwater was supplied to the Tarawa Terrace WTP by well TT-26. Simulated breakthrough of PCE at well TT-26 at the current MCL of 5 µg/L occurred during January 1957. Corresponding breakthrough at the location of well TT-23 occurred during December 1974; however, well TT-23 was not operational until about August 1984.

Simulated maximum and average PCE concentrations at well TT-26 following breakthrough were 851 µg/L and 414 µg/L, respectively. Corresponding maximum and average concentrations at well TT-23 subsequent to the onset of operations were 274 µg/L and 252 µg/L, respectively. Simulated breakthrough of PCE in finished water at the Tarawa Terrace WTP occurred at the current MCL concentration of 5 µg/L during November 1957 and remained at or above a concentration of 40 µg/L from May 1960 until the termination of pumping at water-supply well TT-26 during February 1985. Computed maximum and average PCE concentrations at the WTP were 183 µg/L and 70 µg/L, respectively, during the period November 1957–February 1985, when well TT-26 was removed from service.

Chapter G: Simulation of Three-Dimensional Multispecies, Multiphase Mass Transport of Tetra- chloroethylene (PCE) and Associated Degradation By-Products (Jang and Aral 2008) provides detailed descriptions and analyses of the development and application of a three-dimensional model (TechFlowMP) capable of simulating multispecies and multiphase (water and vapor) transport of PCE and associated degradation by-products—TCE, 1,2-tDCE, and VC. The development of the TechFlowMP model is described in Jang and Aral (2005) and its application to Tarawa Terrace and vicinity also is published as report MESL-02-07 by the Multimedia Environmental Simulations Laboratory in the School of Civil and Environmental Engineering, Georgia Institute of Technology (Jang and Aral 2007). Simulation results show that the maximum concentrations of PCE degradation by-products, TCE, 1,2-tDCE, and VC, generally ranged between 10 µg/L and 100 µg/L in Tarawa Terrace water-supply well TT-26 and between 2 µg/L and 15 µg/L in finished water delivered from the Tarawa Terrace WTP. As part of the degradation by-product simulation using the TechFlowMP model, results were obtained for PCE and PCE degradation by-products dissolved in groundwater and in the vapor phase (above the water table in the unsaturated zone). Analyses of the distribution of vapor- phase PCE and PCE degradation by-products indicate there is potential for vapors to enter buildings at Tarawa Terrace, thereby providing a potential exposure pathway from inhalation of PCE and PCE degradation by-product vapors. At Tarawa Terrace these buildings would include family housing and the elementary school.

Chapter H: Effect of Groundwater Pumping Schedule Variation on Arrival of Tetrachloroethylene (PCE) at Water-Supply Wells and the Water Treatment Plant (Wang and Aral 2008) describes a detailed analysis of the effect of groundwater pumping schedule variation on the arrival of PCE at water-supply wells and at the Tarawa Terrace WTP. Analyses contained in this chapter used the calibrated model parameters described in Chapter C (Faye and Valenzuela In press 2007) and Chapter F (Faye In press 2007b) reports in combination with the groundwater pumping schedule optimization system simulation tool (PSOpS) to assess the influence of unknown and uncertain historical well operations at Tarawa Terrace water-supply wells on PCE concentrations at water-supply wells and at the Tarawa Terrace WTP. This chapter also is published as report MESL-01-07 by the Multimedia Environmental Simulations Laboratory in the School of Civil and Environmental Engineering, Georgia Institute of Technology (Wang and Aral 2007). Variation in the optimal pumping schedules indicates that the arrival time of PCE exceeding the current MCL of 5 µg/L at water-supply well TT-26 varied between May 1956 and August 1959. The corresponding arrival time of PCE exceeding the current MCL of 5 µg/L at the Tarawa Terrace WTP varied between December 1956 and June 1960.